UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/527,922	03/16/2005	Teruhiko Suzuki	450100-05172	8589

22852 7590 12/10/2007
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP
901 NEW YORK AVENUE, NW
WASHINGTON, DC 20001-4413

EXAMINER
YEH, EUENG NAN

ART UNIT	PAPER NUMBER
2624	

MAIL DATE	DELIVERY MODE
12/10/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/527,922	Applicant(s) SUZUKI ET AL.	
	Examiner Eueng-nan Yeh	Art Unit 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-25 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-25 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 16 March 2005 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date Feb 14, 2006; Mar 16, 2005.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Specification

2. The title of the invention, "Image information encoding device and method, and image information decoding device and method" is too general to reveal the real intention to which the claims are directed. A new title is suggested: "An image codec system handling intra-prediction mode with various color spaces and color signal resolutions".

3. The abstract of the disclosure is objected to because it exceeds the 150 words limitation. The abstract should be in a brief and clear narrative of the disclosure as a whole and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. Correction is required. See MPEP § 608.01(b).

4. The disclosure is objected to because of the following informalities and appropriate corrections are required:

- Page 52, line 4, "is expressed as f2 x 4": The correct statement is "is expressed as $\mathbf{fdc}_{2\times 4}$".

Claim Objections - 37 CFR 1.75(a)

5. The following is a quotation of 37 CFR 1.75(a):

> The specification must conclude with a claim particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery.

6. Claims 8, 10, 11, and 13 are objected to under 37 CFR 1.75(a), because of the following informalities: Each claim begins with a capital letter and ends with a period. Periods may not be used elsewhere in the claims except for abbreviations. See MPEP § 608.01(m).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Shen et al. (US 6,360,016 B1), Pohjola (US 2003/0081852 A1), Dierke (US 6,192,188 B1), Zhou (US 2003/0093452 A1), and Schroeder (US 3,679,821).

Regarding claims 1 (apparatus) and 14 (method), Shen discloses an image codec system comprising:

Intra-image prediction means, to generate a prediction image in performing intra-image predictive encoding of the signal (as depicted in figure 1, numeral 112: "... the image data of the objective small region to be processed is inputted to the

adder 102 via the input terminal 101 and a line 113 ... the prediction signal generator 112 generates image data of an intra-frame prediction small region and outputs the generated image data as image data of an optimum prediction small region to the adder 102 via a line 121" at column 22, line 46);

transform means for performing, on a predetermined block size basis, transform of a difference signal between the prediction image generated by the intra-image prediction means and an original image (as depicted in figure 1, numeral 102: "... adder 102 subtracts the corresponding pixel value of the optimum prediction small region obtained from the prediction signal generator 112 from the pixel value of the inputted image data of the target small region to be processed, thereby generating image data of a difference small region of the subtraction result and outputting the image data to the encoder 103 for the execution of a compression coding process ..." at column 22, line 53);

quantization means for adaptively changing quantization technique in accordance with transform processing by the transform means to quantize transform coefficients generated by the transform means (as depicted in figure 1, numeral 105 for the quantization processing);

encoding means for encoding the transform coefficients quantized by the quantization means ("...The quantized DCT coefficients of the small region are outputted to the output terminal 106 *(figure 1)* via a line 116, further transformed into a string of a variable length or fixed length codes" at column 22, line 67).

Shen does not explicitly disclose the color space used. Furthermore, Shen does not teach the color signal resolution and the integral transform.

Pohjola, in the same field of endeavor of codec system ("encoding and decoding video in streaming media solutions" in paragraph 1, line 1), teaches a codec system: "...The invention may also be used as one step in a sequence of difference encoding with optional variation of block size in each step ... The encoding procedure and ideas presented herein are applicable to any color presentation such as RGB, YUV, YCrCb, CieLAB, etc" in paragraph 90, line 13.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the image codec system Shen made with various color spaces application as taught by Pohjola, in order to expand the usefulness of the system so as to be "applicable to any color presentation" in Pohjola paragraph 90, line 25.

The Shen and Pohjola combination does not teach the color signal resolution. Furthermore, Shen and Pohjola combination does not teach the integral transform.

Dierke, in the same field of endeavor of audio/video encoding system ("relates to the field of video compression systems" at column 1, line 8), teaches a system accepts various color signal resolutions: "MPEG standard suggests that the luminance component Y of a video signal may be sampled with respect to the color difference signals Cr, Cb by a ratio of 4-to-1 ... For end users, video sub-sampling typically is performed 2-to-1 in both the vertical and horizontal directions (known as 4:2:0). However, the MPEG standard allows the use of other sampling ratios ..." at column 5, line 50. Furthermore, "... [a] macroblock consists of a 16-pixel by 16-line portion, or four 8-pixel by 8-line blocks, of

luminance components (Y) and several spatially corresponding 8 by 8 blocks of chrominance components Cr and Cb. The number of blocks of chrominance values depends upon which particular format is used. Common color space sampling schemes include 4:4:4 for maximum quality but relatively low compression, 4:2:2 including two Cb chrominance blocks and Cr chrominance blocks, and 4:2:0 including one Cb chrominance block and one Cr chrominance block" at column 6, line 62. Thus, the MPEG standard allows the use of other sampling ratios and the selection of number of blocks of chrominance values depends upon which particular format is used.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the said image codec system of the Shen and Pohjola combination, to be able to process color image at various resolutions as taught by Dierke, in order to have a better compression rate.

The Shen, Pohjola, and Dierke combination does not explicitly teach the integral transformation.

Zhou, in the same field of endeavor of video transform ("video compression and decompression" in paragraph 2, line 1), teaches the major difference between H.26L and MPEG4/H.263: "major differences lies in the transform and quantization. Instead of 8X8 DCT transforms, H.26L uses a 4X4 integer transforms for the residual coding (residual blocks are generated by using the motion compensation for inter-coded macroblocks, and using the intra prediction for intra-coded macroblocks). Both the transform and quantization are designed for 32-arithmetic" in Zhou paragraph 4, line 4. "Preferred embodiments

provide block transforms based on left and right matrix multiplications with a (orthogonal) matrix and its transpose (such as DCT) but use integer-valued elements ..." in Zhou paragraph 11, line 1. Furthermore, Zhou teaches: "In proposed H.26L a 16X16 luminance block is partitioned into 16 4X4 luminance blocks (denoted $Y_{m,n}$ for m,n=0,1,2,3) and each such 4X4 luminance block is approximately DCT transformed with 4X4 orthogonal integer matrix U as in the foregoing; namely, $U\, Y_{m,n}\, U^T$. This yields 16 4X4 transformed blocks, with each 4X4 transformed block having a DC component, denoted $D_{m,n}$ for $U\, Y_{m,n}\, U^T$. Then these 16 DC components can be considered as a 4X4 matrix (the luminance DC block) D with elements D_{ij} for i,j=0,1,2,3 ... [a]pply the integer approximation DCT transform matrix U and scale it to yield transformed 4X4 matrix F_D defined by $F_D = (49/2^{15})\, U\, D\, U^T$ with elements F_{Dij} for i,j=0,1,2,3 ..." in Zhou paragraph 55, line 1. More important, "the 4X4 matrices and inputs and outputs could be other sizes, such as 8X8, 2X2, etc." in Zhou paragraph 99, line 1. The 4X4 Hadamard transform matrix is discussed in Zhou paragraph 65.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the said image codec system of the Shen, Pohjola, and Dierke combination, to be able to perform integral transform as taught by Zhou, in order to have "much higher coding efficiency" in Zhou paragraph 3, line 2.

The Shen, Pohjola, Dierke, and Zhou combination does not explicitly teach the values for a 2X2 integral transform.

Schroeder, in the same field of endeavor of image compression ("to compress the channel capacity or the band of frequencies necessary for the transmission of picture signals" at column 1, line 5), teaches the Hadamard matrix with plus and minus ones such that the transformation process (plus/minus) becomes very fast compares to that of discrete Fourier transformation or DCT. The 2X2 H_2 and 4X4 H_4 Hadamard matrixes are listed as equation 1 and equation 2, respectively at Schroeder column 3, lines 42-52.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the said image codec system of the Shen, Pohjola, Dierke, and Zhou combination, to include 2X2 H_2 and 4X4 H_4 Hadamard integral transforms as taught by Schroeder, in order not only to have a fast transformation but also to "reduce signal redundancy and to lower coder signal entropy" at Schroeder column 1, line 65.

Regarding claims 2, and 15, transform means further performs integral transform of blocks constituted by collecting only DC components after undergone integral transform on the predetermined block size basis (discussed in claims 1 and 14 for the integral transform for the DC components, U D U^T, transform after $Y_{m,n}$ integral transform).

Regarding claims 3 and 16, chroma format signal at least includes 4:2:0 format, 4:2:2 format and 4:4:4 format, and the color space signal at least includes

YCbCr, RGB and XYZ (discussed in claims 1 and 14, for the color spaces and color signal resolutions used).

Regarding claims 4, 5, and 6 (discussed in claim 1, the MPEG standard allows the use of other sampling ratios and the selection of number of blocks of chrominance values depends upon which particular format is used).

Regarding claims 7 and 8 (discussed in claim 1, for $U\ Y_{m,n}\ U^T$ integral transform and $U\ D\ U^T$ for DC components integral transform. The 2X2 H_2 Hadamard transform matrix is also discussed in claim 1).

Regarding claims 9, 10, and 11 (discussed in claim 1, for $U\ Y_{m,n}\ U^T$ integral transform and $U\ D\ U^T$ for DC components integral transform. The 2X2 and 4X4 Hadamard transform matrixes are also discussed in claim 1 as H_2 and H_4, respectively).

Regarding claims 12, and 13 (discussed in claim 1, for $U\ Y_{m,n}\ U^T$ integral transform and $U\ D\ U^T$ for DC components integral transform. The 4X4 H_4 Hadamard transform matrix is also discussed in claim 1).

Regarding claim 17, decoding apparatus comprising:

decoding means for decoding quantized and encoded transform coefficients, a chroma format signal indicating resolution of a color signal and a color space

signal indicating color space (as depicted in Shen figure 1, numeral 107 for the decoder. Discussed in claim 1 for the color space and color signal resolution used);

inverse quantization means for adaptively changing inverse quantization technique in accordance with the chroma format signal and the color space signal to inverse-quantize the transform coefficients decoded by the decoding means (as depicted in Shen figure 1, numeral 108 for inverse quantization);

inverse transform means for performing integral transform of the inverse-quantized blocks (as depicted in Shen figure 1, numeral 109 for the inverse transform. Discussed in claim 1 for the integral transform);

intra-image prediction means for generating a prediction image in performing intra-image predictive decoding of the color signal at a block size corresponding to the chroma format signal and the color space signal by using an output signal from the inverse transform means (discussed in Shen column 23, lines 6 to 32 for the process of intra-image predictive decoding activity).

Regarding claim 18, inverse transform means performs integral transform of the inverse-quantized blocks to further perform integral transform of the respective coefficients on the predetermined block size basis as respective DC components of blocks of a predetermined block size (as depicted in Shen figure 1, numeral 109 for the inverse transform. Discussed in claim 1 for the integral transform for the DC components, $U D U^T$, transform after $Y_{m,n}$ integral transform).

Regarding claim 19, the chroma format signal at least includes 4:2:0 format, 4:2:2 format and 4:4:4 format, and the color space signal at least includes YCbCr, RGB and XYZ (discussed in claims 1, for the color spaces and color signal resolutions used).

Regarding claim 20, the chroma format signal is 4:2:0 format, and the color space signal is YCbCr, the inverse transform means performs integral transform of the inverse-quantized blocks of 2X2 pixel units to further perform integral transform of the transformed respective coefficients as respective DC coefficients of four blocks of 4X4 pixel units which constitute block of 8X8 pixels (as depicted in Shen figure 1, numeral 109 for the inverse transform. Discussed in claim 1, the MPEG standard allows the use of other sampling ratios and the selection of number of blocks of chrominance values depends upon which particular format is used. Also, discussed in claim 1, for $U\ Y_{m,n}\ U^T$ integral transform and $U\ D\ U^T$ for DC components integral transform. The 2X2 H_2 Hadamard transform matrix is also discussed in claim 1).

Regarding claim 21, the chroma format signal is 4:2:2 format, and the color space signal is YCbCr, the inverse transform means performs integral transform of the inverse-quantized blocks of 2X4 pixel units to further perform integral transform of the transformed respective coefficients as respective DC coefficients of eight blocks of 4X4 pixel units which constitute blocks of 8X16

pixels (as depicted in Shen figure 1, numeral 109 for the inverse transform. Discussed in claim 1, the MPEG standard allows the use of other sampling ratios and the selection of number of blocks of chrominance values depends upon which particular format is used. Also, discussed in claim 1, for U $Y_{m,n}$ U^T integral transform and U D U^T for DC components integral transform. The 2X2 and 4X4 Hadamard transform matrixes are also discussed in claim 1 as H_2 and H_4, respectively).

Regarding claim 22, the chroma format signal is 4:4:4 format, and the color space signal is YCbCr, RGB or XYZ, the transform means performs integral transform of the inverse-quantized blocks of 4X4 pixel units to further perform integral transform of the transformed respective coefficients as respective DC coefficients of 16 blocks of 4X4 pixel units which constitute blocks of 16X16 pixels (as depicted in Shen figure 1, numeral 109 for the inverse transform. Discussed in claim 1, the MPEG standard allows the use of other sampling ratios and the selection of number of blocks of chrominance values depends upon which particular format is used. Also, discussed in claim 1, for U $Y_{m,n}$ U^T integral transform and U D U^T for DC components integral transform. The 4X4 H_4 Hadamard transform matrix is also discussed in claim 1).

Regarding claim 23, decoding method comprising:

decoding step of decoding quantized and encoded transform coefficients, a chroma format signal indicating resolution of a color signal, and a color space

signal indicating color space (as depicted in Shen figure 1, numeral 107 for the decoder. Discussed in claim 1 for the color space and color signal resolution used);

an inverse quantization step of adaptively changing inverse-quantization technique in accordance with the chroma format signal and the color space signal to inverse-quantize the transform coefficients decoded at the decoding step (as depicted in Shen figure 1, numeral 108 for inverse quantization);

an inverse transform step of performing integral transform of the inverse-quantized blocks (as depicted in Shen figure 1, numeral 109 for the inverse transform. Discussed in claim 1 for the integral transform),

to further perform, on a predetermined block size basis, integral transform of the respective coefficients as respective DC components of the predetermined block size (discussed in claim 1 for the integral transform for the DC components, U D U^T, transform after $Y_{m,n}$ integral transform),

intra-image prediction step of generating a prediction image in performing intra-image predictive decoding of the color signal at a block size corresponding to the chroma format signal and the color space signal by using an output signal of the inverse transform step (discussed in Shen column 23, lines 6 to 32 for the process of intra-image predictive decoding activity).

Regarding claim 24, at the inverse transform step, integral transform of the inverse-quantized blocks is performed to further perform, on a predetermined block size basis, integral transform of respective coefficients as respective DC

components of blocks of the predetermined block size (as depicted in Shen figure 1, numerals 108 and 109 for inverse quantizing and inverse transform, respectively. Discussed in claim 1, the MPEG standard allows the use of other sampling ratios and the selection of number of blocks of chrominance values depends upon which particular format is used. Integral transform has been discussed in claim 1).

Regarding claim 25, the chroma format signal at least includes 4:2:0 format, 4:2:2 format and 4:4:4 format, and the color space signal at least includes YCbCr, RGB and XYZ (discussed in claim 1, for the color spaces and color signal resolutions used).

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- Nagumo et al. (US 6,608,935 B2): The number of pixels for processing 4:2:0 format is 8X8, for 4:2:2 is 8X16, for 4:4:4 is 16X16.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eueng-nan Yeh whose telephone number is 571-270-1586. The examiner can normally be reached on Monday-Friday 8AM-4:30PM EDT.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on 571-272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

E.Y.
Eueng-nan Yeh
Assistant Patent Examiner
2624

VIKKRAM BALI
PRIMARY EXAMINER